



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899

REPORT OF TEST

Platinum Resistance Thermometer
Hart Scientific Model 5682
S/N 1035

Submitted by

ICL Calibration Laboratories, Inc.
Stuart, Florida

A platinum resistance thermometer (Model 5682, S/N 1035), was calibrated by comparison with a standard platinum resistance thermometer (SPRT) in stirred liquid calibration baths at four temperatures. The sensor and SPRT were immersed to a depth of 30 cm. A triple point of water (TPW) was measured by immersing the probe 26.5 cm in a TPW cell. A continuous measuring current of 1 mA was used in the measurements. The results obtained are:

Bath Temperature °C	Resistance Ω
-195.868	18.9405
-38.802	85.1412
0.01 (TPW)	100.8384
231.912	190.8247
419.506	258.9729

The expanded uncertainty ($k=2$) in the bath temperature measurement of -195.8°C does not exceed $2.3\text{ m}^{\circ}\text{C}$; of -38.8°C does not exceed $2.3\text{ m}^{\circ}\text{C}$, for the range of 95°C to 300°C does not exceed $4.8\text{ m}^{\circ}\text{C}$; for the range of 300°C to 550°C does not exceed $7.5\text{ m}^{\circ}\text{C}$; and for the TPW, $0.04\text{ m}^{\circ}\text{C}$. For a discussion of the uncertainty, see NIST TN 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST TN 1411 "Reproducibility of the Temperature of the Ice Point in Routine Measurements," and NISTIR 6225, "A New NIST Automated Calibration System for Industrial-Grade Platinum Resistance Thermometers."

All temperatures in this report are on the International Temperature Scale of 1990 (ITS-90). This temperature scale was adopted by the International Committee of Weights and Measures at its meeting in September, 1989, and is described in "The International Temperature Scale of 1990", Metrologia 27, No. 1, 3-10 (1990); Metrologia 27, 107 (1990).

For the Director
National Institute of Standards and Technology

Dr. Dean Ripple
Leader, Thermometry Group
Process Measurements Division

Test No.: 264829-01
Completed: May 9, 2001
P.O. No.: 66629

NIST



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

REPORT OF TEST

Platinum Resistance Thermometer
Hart Scientific Model 5680
S/N 1085

Submitted by

ICL Calibration Laboratories, Inc.
Stuart, Florida

A platinum resistance thermometer (Model 5680, S/N 1085), was calibrated by comparison with a standard platinum resistance thermometer (SPRT) in stirred liquid calibration baths at four temperatures. The sensor and SPRT were immersed to a depth of 30 cm. A triple point of water (TPW) was measured by immersing the probe 26.5 cm in a TPW cell. A continuous measuring current of 1 mA was used in the measurements. The results obtained are:

Bath Temperature °C	Resistance Ω
-195.640	4.7778
-38.806	21.3764
0.01 (TPW)	25.3182
231.906	47.9169
419.506	65.0330

The expanded uncertainty ($k=2$) in the bath temperature measurement of -195.6°C does not exceed $2.3\text{ m}^{\circ}\text{C}$, of -38.8°C does not exceed $2.3\text{ m}^{\circ}\text{C}$, for the range of 95°C to 300°C does not exceed $4.8\text{ m}^{\circ}\text{C}$, for the range of 300°C to 550°C does not exceed $7.5\text{ m}^{\circ}\text{C}$; and for the TPW, $0.04\text{ m}^{\circ}\text{C}$. For a discussion of the uncertainty, see NIST TN 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST TN 1411 "Reproducibility of the Temperature of the Ice Point in Routine Measurements," and NISTIR 6225, "A New NIST Automated Calibration System for Industrial-Grade Platinum Resistance Thermometers."

All temperatures in this report are on the International Temperature Scale of 1990 (ITS-90). This temperature scale was adopted by the International Committee of Weights and Measures at its meeting in September, 1989, and is described in "The International Temperature Scale of 1990", Metrologia 27, No. 1, 3-10 (1990); Metrologia 27, 107 (1990).

For the Director
National Institute of Standards and Technology

Dr. Dean Ripple
Leader, Thermometry Group
Process Measurements Division

Test No.: 266710-02
Completed: April 10, 2002
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NIST



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

REPORT OF TEST

Platinum Resistance Thermometer
Hart Scientific Model 5680
S/N 1085

Submitted by

ICL Calibration Laboratories, Inc.
Stuart, Florida

A platinum resistance thermometer (Model 5680, S/N 1085), was calibrated by comparison with a standard platinum resistance thermometer (SPRT) in stirred liquid calibration baths at four temperatures. The sensor and SPRT were immersed to a depth of 30 cm. A triple point of water (TPW) was measured by immersing the probe 26.5 cm in a TPW cell. A continuous measuring current of 1 mA was used in the measurements. The results obtained are:

Bath Temperature °C	Resistance Ω
-195.643	4.7769
-38.799	21.3756
0.01 (TPW)	25.3170
231.962	47.9191
419.559	65.0323

The expanded uncertainty ($k=2$) in the bath temperature measurement of -195.6°C does not exceed $2.3\text{ m}^{\circ}\text{C}$, of -38.8°C does not exceed $2.3\text{ m}^{\circ}\text{C}$, for the range of 95°C to 300°C does not exceed $4.8\text{ m}^{\circ}\text{C}$, for the range of 300°C to 550°C does not exceed $7.5\text{ m}^{\circ}\text{C}$; and for the TPW, $1.4\text{ m}^{\circ}\text{C}$. For a discussion of the uncertainty, see NIST TN 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST TN 1411 "Reproducibility of the Temperature of the Ice Point in Routine Measurements," and NISTIR 6225, "A New NIST Automated Calibration System for Industrial-Grade Platinum Resistance Thermometers."

All temperatures in this report are on the International Temperature Scale of 1990 (ITS-90). This temperature scale was adopted by the International Committee of Weights and Measures at its meeting in September, 1989, and is described in "The International Temperature Scale of 1990", Metrologia 27, No. 1, 3-10 (1990); Metrologia 27, 107 (1990).

For the Director
National Institute of Standards and Technology

Dr. Dean Ripple
Leader, Thermometry Group
Process Measurements Division

Test No.: 263085-00
Completed: April 19, 2000
P.O. No.: 66265A

NIST



REPORT OF CALIBRATION

International Temperature Scale of 1990

Standard Platinum Resistance Thermometer
Hart Scientific Model 5699
Serial Number 0159

Submitted by:
ICL Calibration Laboratories, Inc.
Stuart, FL 34994

This standard platinum resistance thermometer (SPRT) was calibrated with an AC bridge operating at a frequency of 30 Hz and with continuous measuring currents of 1.0 mA and 1.414 mA. In accordance with the International Temperature Scale of 1990 (ITS-90) that was officially adopted by the Comité International des Poids et Mesures (CIPM) in September 1989, the subranges from 83.8058 K to 273.16 K and 273.15 K to 692.677 K, with the following fixed points and their stated expanded uncertainties ($k=2$), were used to calibrate the thermometer. For a description of the uncertainties, see NISTIR 5319, 16 pp., (1994), entitled "Assessment of Uncertainties of Calibration of Resistance Thermometers at the National Institute of Standards and Technology."

Fixed Point		Temperature		Expanded Uncertainty
		T_{90} (K)	t_{90} (°C)	where $k=2$ (mK)
Ar	TP	83.8058	-189.3442	0.08
Hg	TP	234.3156	-38.8344	0.15
H ₂ O	TP	273.16	0.01	0.02
Sn	FP	505.078	231.928	0.24
Zn	FP	692.677	419.527	0.41

The following values were determined for the coefficients of the pertinent deviation functions of the ITS-90, as given in the attached material describing the scale. The attached tables were generated using these values.

Coefficients for Zero-Power Dissipation Calibration

$a_4 = -8.1949689\text{E-}05$
 $b_4 = -1.6559779\text{E-}06$

$a_8 = -1.0087772\text{E-}04$
 $b_8 = -7.2796096\text{E-}06$

Coefficients for 1 mA Calibration

$a_4 = -8.4240654\text{E-}05$ $a_8 = -1.0147545\text{E-}04$
 $b_4 = -2.3376083\text{E-}06$ $b_8 = -7.7646210\text{E-}06$

The resistance of this thermometer at 273.16 K was calculated to be 25.4670 Ω at zero-power dissipation and 25.4670 Ω at 1 mA. During calibration, the resistance at 273.16 K changed by the equivalent of 0.3 mK at zero-power dissipation and 0.3 mK at 1 mA.

This thermometer is satisfactory as a defining instrument of the ITS-90 in accordance with the criteria that $W(302.9146 \text{ K}) \geq 1.118 \text{ 07}$ or $W(234.3156 \text{ K}) \leq 0.844 \text{ 235}$.

For the Director,
National Institute of Standards and Technology

Dean C. Ripple
Leader, Thermometry Group
Process Measurements Division

October 7, 2003
Test No.: 836/269257-03
Purchase Order No.: 68157